REMARKS

Claims 1 and 2 have been amended, claims 45-47 have been added and claim 41 has been canceled. Claims 1-3, 6, 8, 11-13, 20, 22-24, 26, 27, 29-31, 36, 37 and 45-47 remain in the application. This Preliminary Amendment accompanies a request for Continued Prosecution application. Examination of the pending claims is requested.

Claims 1 and 2 stand rejected under 35 U.S.C. §102(a) as being anticipated by Kasulke et al., "Solder Ball Bumper (SBB) - A Flexible Equipment For FC, CSP, BGA and Printed Circuit Boards". Claims 1, 3, 11-13, 27, 29 and 31 stand rejected under 35 U.S.C. §102(b) as being anticipated by Desai et al., U.S. Patent No. 5,479,703. Claims 2, 6, 8, 20, 22-24, 26, 30, 36 and 37 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Desai et al. in view of Kasulke et al.

Claims 1 and 2 have been amended to clarify the language of the claims, however these amendments do not alter the scope of the claims.

The Examiner states (p. 3, item 7(I)) that "In regards to the merits of Kasulke et al, the Applicants argue that the teachings of Kasulke fail to put the invention in to public domain. Therefore, the rejections drawn to the merits of Kasulke are defective and should be withdrawn.

The Examiner has no reason to believe that the publication to Kasulke et al was not put into public domain. The publication to

Kasulke et al appears to be a published document open to the public. Furthermore, if the publication to Kasulke et al was not a published document, then why did Applicants disclose this as relevant prior art in their IDS (Item AR in Paper No. 3)? Do Applicants believe that Kasulke et al is not relevant prior art? Therefore, the Examiner maintains the rejections with regards to the merits of Kasulke et al."

The Examiner is mistaken as to what Kasulke et al. teach and further with respect to the traverse provided in the Response dated March 9, 2000.

To assist the Examiner in understanding the subject matter of claims 1 and 2, what is taught or disclosed by Kasulke et al. and the appropriate standards for a rejection under 35 U.S.C. §102(a), Applicants first refer to MPEP §2121.01, entitled "Use of Prior Art in Rejections Where Operability Is In Question".

This MPEP section states that ""In determining that quantum of prior art disclosure which is necessary to declare an applicant's invention 'not novel' or 'anticipated' within section 102, the stated test is whether a reference contains an 'enabling disclosure'... ." *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596 (CCPA 1968). A reference contains an "enabling disclosure" <u>if the public was in possession of the claimed invention before the date of invention</u>. "Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the

claimed invention." *In re Donohue*, 766 F.2d 531, 226 USPQ 619 (Fed. Cir. 1985)."

Claim 1, as amended, recites "A method of bonding balls of solder to bond pads on a substrate comprising: contemporaneously retaining at least two balls of solder over different respective bond pads on a substrate in the absence of flux; and with the at least two balls of solder so retained, exposing the at least two balls of solder to bonding conditions effective to bond the at least two balls of solder with their associated bond pads", which is not taught or disclosed by Kasulke et al.

In contrast, Kasulke et al. teach a method of applying and then melting one ball of solder at a time (see, e.g., Abstract, 1st sentence). The teachings of Kasulke et al., when fairly considered as prior art, fail to provide an enabling disclosure for the invention as recited in claim 1. Kasulke et al. teach (2nd col., top) that "capabilities and benefits of the Solder Ball Bumping technology" of Kasulke et al. include that "The solder ball placement and reflow is performed in one step. No additional process steps are required."

Balls of solder that are "contemporaneously retained" on a substrate according to the teachings of Kasulke et al. have already been individually melted and are metallurgically joined with features formed on the substrate. As such, there is no need for joining the balls to the substrate by "exposing the at least two balls of solder to bonding

conditions effective to bond the at least two balls of solder with their associated bond pads" after the balls are retained on the substrate as recited in claim 1.

Moreover, because the system taught by Kasulke et al. relies on co-axial alignment of the laser optics and the capillary for placement of the individual solder balls (see, e.g., Fig. 3), the system taught by Kasulke et al. cannot be readily modified to arrive at the invention as recited in claims 1 and 2.

Kasulke et al. teach (4th col.) that "While the bond head drives the capillary exactly above the pad position, solder balls from the loading station are singulated through a singulation unit simultaneously." Kasulke et al. also teach that "Using a pneumatic pulse, the ball is transported from the singulation unit down to the tip of the capillary. The reflow of the solder ball is performed by a laser beam which passes through a glass fiber into the capillary directly above the placed ball."

In other words, Kasulke et al. teach a method of placing and then melting one solder ball at time. Kasulke et al. teach that this provides the advantage of placing and melting one solder ball at a time. Accordingly, Kasulke et al. do not teach or disclose the invention as recited in claim 1. For at least these reasons, the rejection of claim 1 should be withdrawn, and claim 1 should be allowed.

Desai et al. teach (col. 8, lines 52-65; col. 9, line 61 through col. 10, line 30) placement of balls comprising high temperature melting point materials such as Au-plated Cu balls having a reflow temperature of 1,062°C (col. 10, lines 4-9), on through-plated vias coated with material having a much lower melting point, e.g., SnPb eutectic alloy having a reflow temperature of 183°C. The balls are then attached by melting the material coating the through-plated vias to solder the balls to the vias. Desai et al. do not teach use of balls of solder for joining substrates as recited in claim 1.

In maintaining the rejection of claim 1 over Desai et al., the Examiner states (p. 4, item 7(II)) that "The use of solder balls for joining substrates is discussed at, for example, col. 5, line 64 to col. 6, line 1:

> The chip is placed on top of the card so that the solder balls contact the appropriate points on the chip. The chip solder ball and card assembly is then **soldered together using known solder techniques** discussed above."

The Examiner is mistaken in interpreting this to mean that balls of solder are being melted. The "known soldering techniques discussed above" include (col. 5, line 22) "conventional wave soldering" and (col. 5, lines 39-40) "immersion soldering", both of which add solder from the bath to the items to be soldered and neither of which relies on balls of solder to melt and reflow to achieve soldering.

The Examiner states (p. 4, item 7(II)(2)) that "placement of the balls of solder is taught by Desai et al in, for example, Figure 4, in which Desai places balls 25 of solder in at least nine different locations." The Examiner is mistaken.

Desai et al. are using the term "solder balls" to refer to conductive balls of material used together with solder to secure two pieces together, and are not using the term "solder balls" to mean "balls of solder" as mistakenly stated in the Office Action.

Evidence for this interpretation is found in the issued patent. The term "balls of solder" does not appear anywhere in Desai et al. The term "solder balls" appears at least 13 times. Desai states (col. 8, lines 52-54) that "The balls used to secure the capless cores together may be formed form an inner core of copper with a precise amount of gold plated on the outside." Such solder balls are stated (col. 10, lines 4-6) to have a melting point of 1260°C, which is clearly too high for balls of solder, i.e., metallic balls intended to be melted during a soldering process.

Desai et al. teach (see col. 10, lines 18-20) that "When the reflow temperature of the plating material [formed in the through plated holes, see lines 6-7] is achieved, the melted tin will wet the gold plated copper balls [25], flowing around them and securing them to the core." and that (col. 9, line 64 through col. 10, line 9) "The apparatus may be subjected to means to cause the plating material on the plated

through holes and the vias on the capless core to reach a temperature of approximately 200°-240°C. thereby melting the tin included in the plating material" and that this causes "the reflow of only the plating material and not the gold plated balls." This point is also made at col. 8, lines 52-65, where Desai et al. state that "This differential melting point makes it possible to subject the capless cores to a soldering process which will melt the material plating the through holes causing it to flow and surround and adhere to the balls but not melt the balls."

The Examiner states (p. 8, item 7(II)(3)) that "Reflowing of the balls of solder is explicitly discussed beginning at col. 9, line 61 to col. 10, line 30." The Examiner is mistaken.

As noted immediately above, what is discussed in this passage, and is further discussed in col. 8, lines 52-65 and col. 10, lines 18-30 and 41-44, is melting of plating material within through plated vias to wet "solder balls" that are not in fact melted. Desai et al. clearly show in Figs. 10 and 11 that following the reflow operation, the balls 25 have not been melted.

Desai et al. thus not only fail to teach "balls of solder", as recited in claims 1 and 2, but teach away from the recitation in claim 2 that "exposing comprises laser-bonding the at least two balls of solder". The rejection of claims 1 and 2 is thus in error and should be withdrawn, and claims 1 and 2 should be allowed.

Amended claim 3 recites "A method of bonding balls of solder to bond pads on a substrate comprising: placing at least portions of a plurality of balls of solder within a frame and in registered alignment with individual bond pads over a substrate; and while the ball portions are within the frame, exposing the balls to bonding conditions effective to bond the balls with their associated bond pads." As noted above, Desai et al. do not teach placement of balls of solder, as recited in claim 3.

Claim 13 recites "A method of bonding balls of solder to bond pads on a substrate comprising: providing a frame having a plurality of holes sized to receive individual solder balls; delivering individual balls of solder into the holes from over the frame; placing the balls into registered alignment, while the balls are in the holes, with a plurality of individual bond pads over a substrate; and bonding the balls with their individual associated bond pads." Desai et al. do not teach use of balls of solder for joining substrates as recited in claim 13.

Claim 27 recites "A method of bonding a ball of solder to a bond pad on a substrate comprising: providing a frame having a hole; providing a ball of solder having an outer surface; retaining the ball of solder within the hole in an ambient processing environment which is generally uniform over the entirety of the ball's outer surface; and while the ball of solder is within the hole, bonding the ball of solder with an

associated bond pad on a substrate." Desai et al. do not teach bonding using balls of solder, as noted above and as recited in claim 27.

Claim 31 recites "A method of bonding balls of solder to bond pads on a substrate comprising: providing a surface having a plurality of holes therein; providing a plurality of balls of solder over the surface; depositing some of the balls of solder into at least some of the holes; and bonding the balls of solder which were deposited into the holes to individual associated bond pads positioned on a substrate proximate the holes." Desai et al. do not teach bonding using balls of solder, as noted above and as recited in claim 31.

For at least these reasons, Desai et al. do not anticipate the invention as recited in any of claims 1, 3, 13, 27 and 31. Dependent claims 11, 12 and 29 claims distinguish by virtue of dependence from an allowable base claim and for their own recited features that are not shown by the cited referece. Accordingly, the rejection of claims 1, 3, 11-13, 27, 29 and 31 should be withdrawn, and claims 1, 3, 11-13, 27, 29 and 31 should be allowed.

Applicants note the requirements of MPEP §2145(X), entitled "ARGUING IMPROPER RATIONALES FOR COMBINING REFERENCES", section D(2), which states, inter alia, that "It is improper to combine references where the references teach away from their combinations."

Kasulke et al. teach a method of applying and then melting one ball of solder at a time (see, e.g., Abstract, 1st sentence). Kasulke et al. teach (2nd col., top) that "capabilities and benefits of the Solder Ball Bumping technology" of Kasulke et al. include that "The solder ball placement and reflow is performed in one step. No additional process steps are required."

Kasulke et al. teach (4th col.) that "While the bond head drives the capillary exactly above the pad position, solder balls from the loading station are singulated through a singulation unit simultaneously." Kasulke et al. also teach that "Using a pneumatic pulse, the ball is transported from the singulation unit down to the tip of the capillary. The reflow of the solder ball is performed by a laser beam which passes through a glass fiber into the capillary directly above the placed ball."

Moreover, because the system taught by Kasulke et al. relies on co-axial alignment of the laser optics and the capillary for placement of the individual solder balls (see, e.g., Fig. 3), the system taught by Kasulke et al. cannot be readily modified to contemporaneously place multiple solder balls as recited in the claims and as taught by Desai et al.

Desai et al. teach (col. 8, lines 52-65; col. 9, line 61 through col. 10, line 30) a series of steps including placement of balls comprising high temperature melting point materials such as Au-plated

Cu balls having a reflow temperature of 1,062°C (col. 10, lines 4-9), on through-plated vias coated with material having a much lower melting point, e.g., SnPb eutectic alloy having a reflow temperature of 183°C. The balls are then attached by melting the material coating the through-plated vias to solder the balls to the vias. Desai et al. do not teach melting of balls of solder for anything, in contrast to the teachings of Kasulke et al.

In fact, Desai et al. teach (col. 7, lines 43-47) that their method avoids problems associated with high temperature gold-based solders and further that their method avoids formation of intermetallic compounds in the cap-core bond process.

Desai et al. thus teach away from the single ball of solder at a time process of Kasulke et al. and in fact teach away from use of meltable balls of solder. Kasulke et al., on the other hand, teach away from reflowing solder to attach multiple conductive balls simultaneously as taught by Desai et al.

Moreover, the apparatus of Kasulke et al. cannot be adapted to contemporaneously place multiple balls for subsequent soldering operations, as noted above with respect to the rejection of claim 1, without rendering the apparatus of Kasulke et al. inoperative for its intended purpose. Similarly, the teachings of Desai et al. are rendered unsuitable for their intended purpose in attempting to combine them with the teachings of Kasulke et al. or in attempting to adapt them to

provide the invention as recited in any of Applicant's independent claims.

As noted above, MPEP §2145(X), section D(2), states that "It is improper to combine references where the references teach away from their combinations."

Applicants note the requirements of MPEP §2141.02, entitled "Differences Between Prior Art and Claimed Invention", stating that "PRIOR ART MUST BE CONSIDERED IN ITS ENTIRETY, INCLUDING DISCLOSURES THAT TEACH AWAY FROM THE CLAIMS". This MPEP section further states that "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984)".

Applicants also note the requirements of MPEP §2143.01, entitled "Suggestion or Motivation to Modify the References", stating that "THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE". This MPEP section further states that "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)."

The references themselves teach away from the combination proposed in the Office Action, and the proposed modifications render the teachings of both references unsatisfactory for their intended purposes.

Further, combining the references fails to provide the invention as recited in any of the independent claims and fails to meet the requirements of MPEP §706.02(j).

For at least these reasons, the rejection under 35 U.S.C. §103(a) of claims 2, 6, 8, 20, 22-24, 26, 30, 36 and 37 should be withdrawn, and claims 2, 6, 8, 20, 22-24, 26, 30, 36 and 37 should be allowed.

New claims 45-47 are supported by text appearing at p. 4, line 9 through p. 9, line 15 of the specification as originally filed. No new matter is added by new claims 45-47. New claims 45-47 distinguish over the art of record and are allowable.

In view of the foregoing, allowance of the pending claims is requested. The Examiner is requested to phone the undersigned in the event that the next Office Action is one other that a Notice of Allowance. The undersigned is available for telephone consultation at any time during normal business hours (Pacific Time Zone).

Further, duplicates of and copies of previously-filed Information Disclosure Statement and Form PTO-1449 are submitted for which an initialed copy of the Form PTO-1449 has not be received from the Examiner. This Information Disclosure Statement was initially submitted

to the U.S. Patent and Trademark Office on October 27, 1998. To the extent the PTO-1449 has not already been initialed, and a copy thereof placed in the file, such examination and initialing is requested at this time, and the return of an initialed and dated copy of the Form PTO-1449 to the undersigned.

Respectfully submitted,

Dated: Aug 10, 2000

By: _____

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